Torch for Bead Forming Process

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Abstract
The manufacturing process of beads is a very challenging process as no specialized machines exist to produce them. The production of beads requires high individual skills as well as modified machines to generate a fire source for the purpose of heating the glass which is the raw material of the bead. The current machine used by Victoria's Enterprise is a modified machine that is used for the purpose of gas welding. However, the machine is often damaged and the spread of heat is uneven. The machine is also too bulky and difficult to divert from one place to another. This innovation is a portable HHO Generator that is capable of generating a concentrated heat needed to solve the problem. HHO Generator that separates water molecules into the gas and has a mixture of oxygen and hydrogen gas to generate flame. The machine comes with a special nozzle designed to produce a consistent and uniform heat with adequate heat flow rate corresponding to the beads manufacturing process. The machine is also portable and can be loaded into small vehicles. This machine will ease the beads manufacturing process and can be widely distributed to villagers in Sarawak to enable them to generate income from handicrafts.
Keywords: beads, heat, nozzle

1.0 Introduction

Beads have been made of glass for over 5,000 years. The discovery of fire was the essential step in glass bead making. There is evidence as early as 2340-2180 BC in Mesopotamia of a method known as "core-forming" where a metal mandrel with pieces of glass held over a flame were used (VenetienBeadShop, 2018). The technology for glass bead making is among the oldest human arts, and it is passed down till today, beads are made by holding glass rods over a flame, then gently winding the molten glass over the metal shaft (mandrel).

Glass beads accessories have indeed become the culture of the Orang Ulu community and are inherited from generation to generation. Since it is a legacy, a hundred-year-old glass beads are able to reach thousands of dollars, while the price of a glass bead can reach hundreds of dollars. However, the difficulty in obtaining local glass beads has forced man-made handicraft manufacturers to reserve supplies from outside Malaysia especially Indonesia. “I am determined to find a glass-making course, so I almost go to Indonesia, "said glass manicurist Victoria Mujan Nyeigok, 39, a

Kayan woman from Tubau, Bintulu in Utusan Malaysia (PARAN, 2010). The ready-made glass beads can be used as a variety of interesting accessories such as earrings, bracelets, necklaces and chain pieces. Its uniqueness in various colors and shapes such as round, flat, rectangular and oval is best suited as a gift.

A study was conducted at Victoria's Enterprise that manufactures beads from glass or silica based material. A gas blow torched fueled by Liquid Petroleum Gas (LPG) or Acetylene is used to heat the material in a conventional way. A conventional blow torch requires large fuel consumption and involves a lot of wastage. The process of starting and stopping of the gas fueled blow torch is more complicated. Victoria's Enterprise has made some innovation modifying arc welder as a torch as shown in Figure 1. Despite this innovation, there are several drawbacks and challenges making its manufacturing process difficult. The problems are heat from the plasma arc is uneven at the torch as there is no means of controlling the arc formation or directing the heat from the arc plasma. The arc welder is large in size and not portable. Based on these problems, this project is intended to provide a solution to Victoria's Enterprise glass/silica heating process by designing and fabricating an electric arc blow torch that could address Victoria's Enterprise bead manufacturing problems. The usefulness of the machine also can be expend to other’s beads manufacturing companies.

Figure 1: Modified arc torch uses by Victoria’s Enterprise

2.0 Material and Methods

An HHO or brown gas generator is an interesting and often misunderstood technology. The brown gas generator uses electrolysis to split water (H_2O) into its base molecules, 2 hydrogen and 1 oxygen molecule (Electrified, 2018). This is why it is often referred to as an HHO gas generator and this is an alternative to Liquid Petroleum Gas or Acetylene that is used by Victoria's Enterprise.

Figure 2 shows that the illustration of the HHO working system. It is called 'hydrogen cell' or 'hydrogen generator' because it produces hydrogen and oxygen simultaneously through the process of electrolysis shown below. The process starts with distilled water and biodegradable electrolyte are pour into the system. This will generate maximum control over the process of electrolysis. When distilled water is added to the system, it begins to collapse the hydrogen (two parts) and oxygen (one part) in perfectly clean condition - 99.99% purity (Hydrox Systems, 2018). Due to the advantages of its principles, the HHO generator was chosen to become the bead forming machine. This machine was designed and fabricated to have an electric arc torch with plasma control that able to produce uniform heat distribution and temperature control. It also come with easy standard operation procedure (SOP) with enhance safety features.

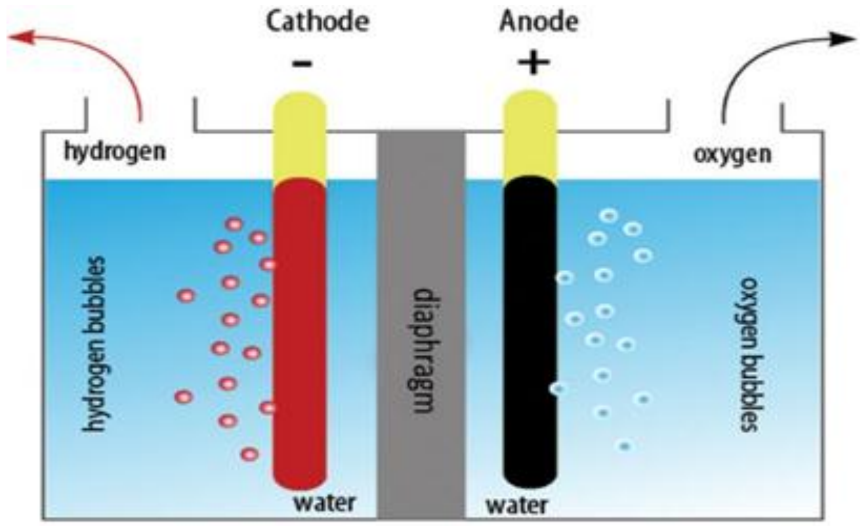

Figure 2: Standard Electrolysis (Hydrox Systems, 2018)

There were a few experiments carried out to determine the best fit parameters for designing the HHO nozzle torch for beads forming process. Variables such as the number of holes, the diameter of holes and the sufficient hydrogen flow rate for the HHO generator were investigated in this project. These experiments were conducted with the supervision and recommendations from Mujan Nyeigen, the director of Victoria’s Enterprise. For the first experiment, the appropriate number of holes (5, 6, 7 and 8) in a nozzle was tested with the hole diameter is fixed at 0.5mm. After determining the suitable number of holes, the subsequent experiment was to determine suitable diameter of nozzle holes and this was done by varying the diameter size from 0.5mm to 0.8mm at a fixed 7 holes nozzle. With the number and diameter of nozzle holes fixed respectively (7 holes with 0.6mm diameter), final experiment was to determine the best hydrogen flow rate for the bead forming process. Finally, after the machine was delivered, the productivity data of beads in Victoria's Enterprise within the first 3 months were gained to evaluate the performance of the machine.

3.0 Result and Discussion

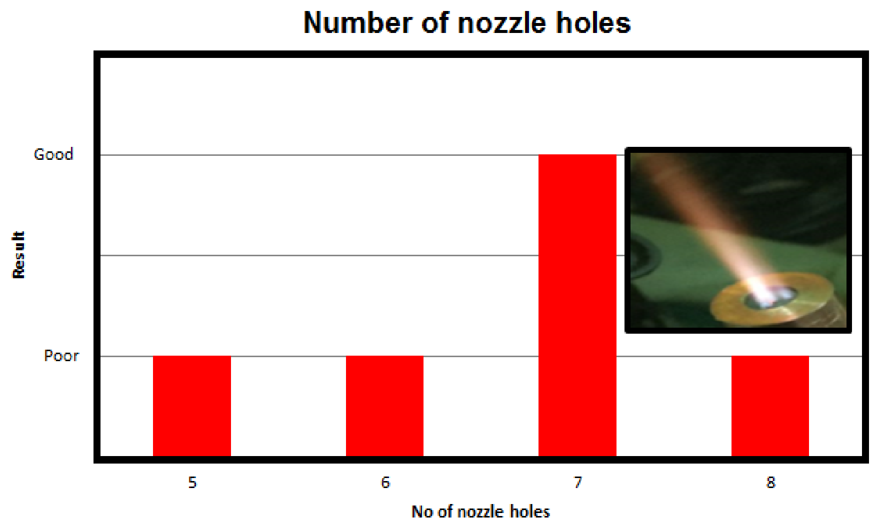

Figure 3: Number of holes in a nozzle (inset picture: flame of the seven holes nozzle)

Figure 3 shows the results of the number of holes in a nozzle. Based on the observation of the shape and surface formed, the nozzle with 7 holes produce the best beads. The heat is adequate to melt the glass rod and shaping of the bead is smooth with this setup. When the number of holes increases to 8 holes, the glass becomes too molten and shaping of the bead need to be performed in urgency. Thus, the best setup is the nozzle with 7 holes.

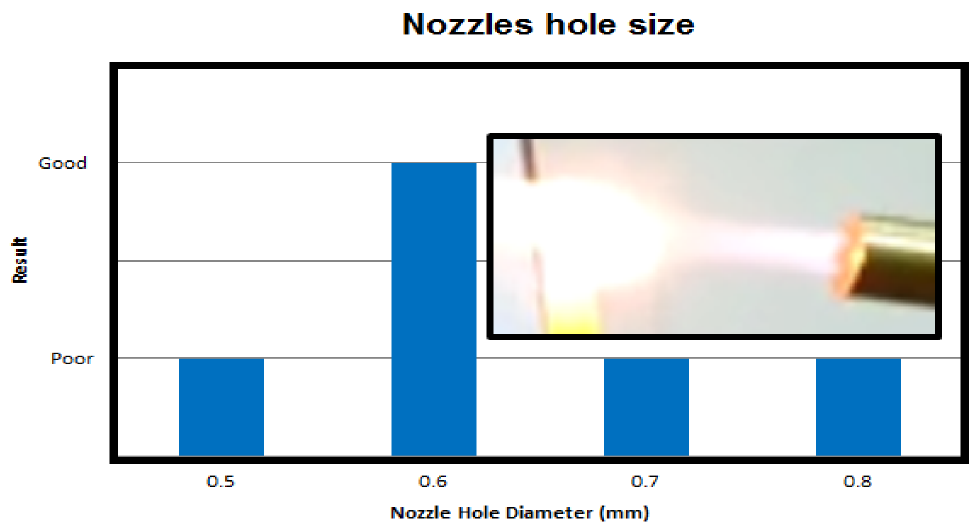

Figure 4: Nozzle hole diameter (inset picture: flame of 0.6 diameter in seven holes nozzle)

Figure 4 illustrates the results of the nozzle hole diameter and it shows that 0.6mm diameter produced the best outcome with regards to the quality of the beads. When the diameter setup was 0.5mm, the heat produced was insufficient and it took long duration to melt the glass rod. Setting of diameter higher than 0.6mm (0.7mm and 0.8mm) causes strong heat distribution and lead to incapability to have full control in the bead shape formation.

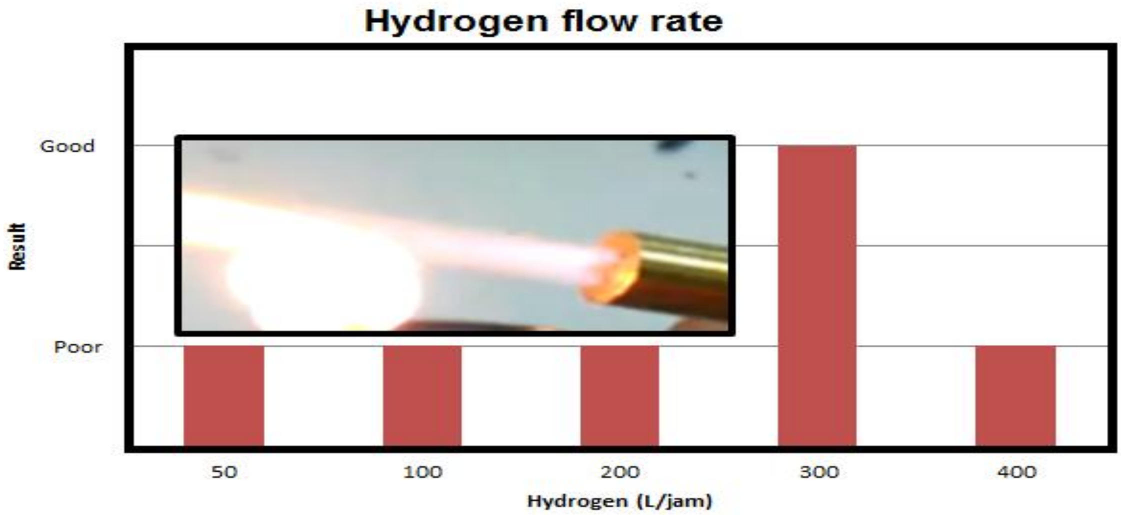

Figure 5: Hydrogen flow rate

Similarly, in the experiment of hydrogen flow rate, Figure 5 indicates that the flow rate value of 300 liter/hour is the most appropriate in beads forming process.

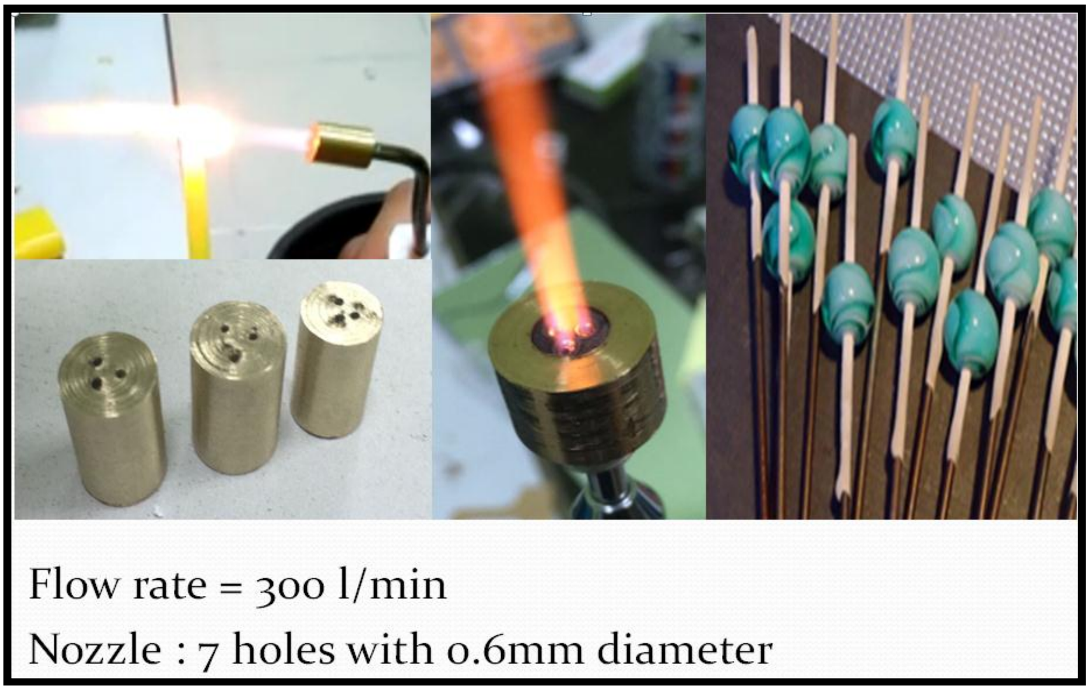

Figure 6: Summary of the final setting

Eventually, Figure 6 reviews the best setting of the HHO bead forming torch with the configuration of 7 holes nozzle with 0.6mm diameter and operate with hydrogen flow rate of 300 liter/hour.

Figure 7: Bead forming machine

Additionally, the whole system was fabricated with a foldable table which make the bead making process easier and also with high mobility as in Figure 7.

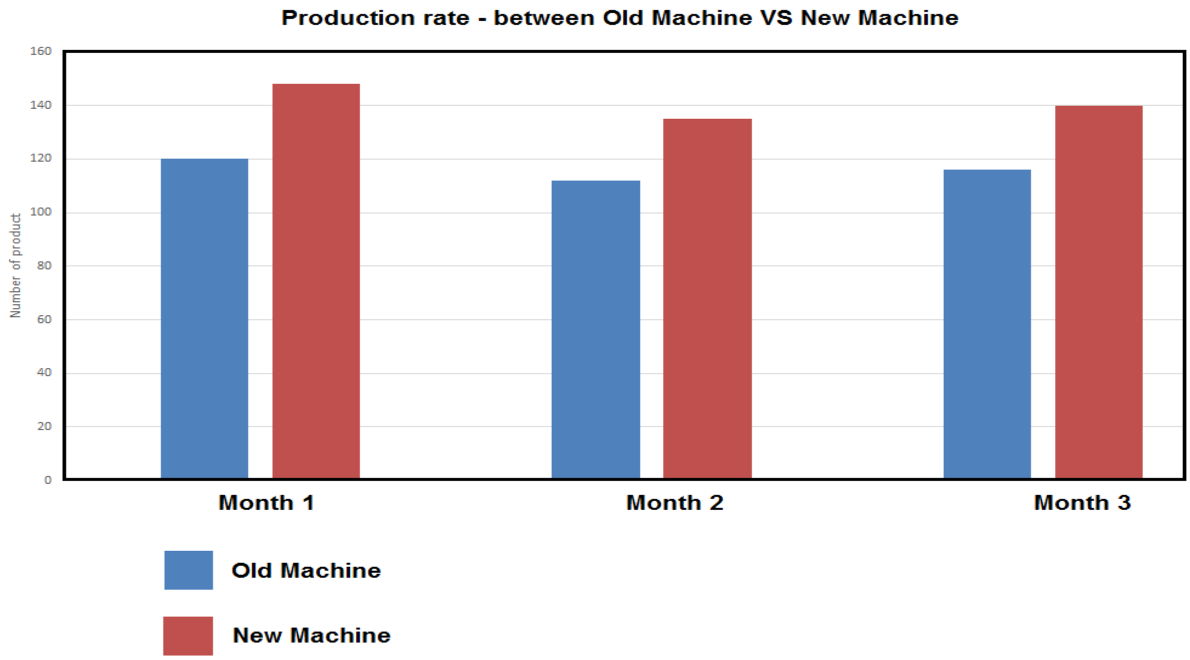

Figure 8: Production rate

Figure 8 shows the production rate between the old machine and new delivered machine within first 3 months of delivery. From the graph, an increment of productivity of bead production with the HHO bead forming torch at approximately an average of 21.5% can be seen for every month productivity. This indicates the success of the machine created and hopes that it can be widely applied in the bead forming industry.

4.0 Conclusion

Overall, the main objective for this project, which is to design and fabrication of an electric arc blow torch that could address Victoria's Enterprise bead manufacturing problems was achieved. The best configuration for the machine is 7 holes nozzle with 0.6mm diameter and 300l/min flow rate. Subsequently, the production rate for the first 3 months upon delivery produced a mean 21.5 increase of productivity. Hence, the usefulness of the machine also can be expend to other's beads manufacturing companies.

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